

**EXPRESS TERMS  
FOR  
PROPOSED BUILDING STANDARDS  
OF THE  
DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT  
REGARDING THE ADOPTION BY REFERENCE OF THE  
2006 INTERNATIONAL BUILDING CODE (IBC) WITH PROPOSED AMENDMENTS INTO THE  
2007 CALIFORNIA BUILDING CODE (CBC)  
CALIFORNIA CODE OF REGULATIONS, TITLE 24, PART 2**

The Department of Housing and Community Development (HCD) proposes to adopt the 2006 edition of the International Building Code (IBC) for codification and effectiveness into the 2007 edition of the California Building Code (CBC) as presented on the following pages, including any necessary amendments. HCD further proposes to:

- Repeal the 2001 edition of the California Building Code;
- Repeal amendments to the model codes that are no longer necessary, repeal or amend building standards that are not addressed by a model code;
- Relocate or codify existing adopted and necessary amendments to the model code into the format of the model code proposed for adoption, the action of which has no regulatory effect; adopt new necessary amendments to the model code proposed for adoption; and/or
- Adopt new building standards that are not addressed by the model code proposed for adoption

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**LEGEND FOR EXPRESS TERMS:**

1. Existing California amendments or code language being modified: All such language appears in *italics*, modified language is underlined or in ~~strikeout~~.
  2. New California amendments: All such language appears *underlined and in italics*.
  3. Repealed text: All such language appears in ~~strikeout~~.
  4. Notation: Authority and Reference citations are provided at the end of each chapter.
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**SPECIAL NOTE:** THIS RULEMAKING IS DIVIDED INTO FOUR ITEMS: ITEM #1: STRUCTURAL STANDARDS; ITEM #2: NON-STRUCTURAL STANDARDS; ITEM #3: ACCESSIBILITY STANDARDS; ITEM #4: STRAWBALE STANDARDS

**ITEM #4: STRAWBALE STANDARDS**

**APPENDIX L**  
**STRAWBALE CONSTRUCTION**

**(Note: Adopt entire appendix.)**

**APPENDIX L – STRAWBALE CONSTRUCTION**

**Section**

**L101 General**

**L102 Definitions**

**L103 Bales**

**L104 Moisture**

**L105 Structure**

**L106 Finishes**

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## **SECTION L101**

### **GENERAL**

**L101.1 Scope.** *This appendix shall govern the use of baled straw as a building material, and shall apply to Group R occupancies, Group U occupancies and other occupancies when secondary and appurtenant to Group R or Group U occupancies. Unless stated otherwise in this appendix, all other provisions in this code shall apply to structures using baled straw as a building material.*

**L101.2 General.** *Within the provisions of this appendix, straw bales may be used as a structural or non-structural material. Structural uses include elements designed to support gravity loads, and elements designed to resist in-plane wind and seismic loads. Non-structural uses include, but are not limited to, infill walls, insulation, landscape walls, and benches.*

**L101.3 Alternatives.** *Alternatives to the provisions in this appendix may be used where the building official finds the proposed design complies with the intent of this appendix and this code.*

## **SECTION L102**

### **DEFINITIONS**

**L102.1 General.** *The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.*

**Bale.** *Equivalent to "straw bale" for the purposes of this appendix.*

**Flake.** *A slab of straw removed from an untied bale. In particular, an intact slab (3-5" thick) (76-127mm) as created by the baling machine.*

**Laid Flat.** *Stacking bales so the sides with the largest area are horizontal, and the longest dimension of this area is parallel with the wall plane.*

**Laid On-edge.** *Stacking bales so the sides with the largest area are vertical and the longest dimension of this area is horizontal and parallel with the wall plane.*

**Loadbearing.** *A strawbale wall or other element which bears the gravity loads (dead and live) of the roof and/or floor above. (compare with "Structural")*

**Mesh.** *An openwork fabric of linked strands of metal, plastic, or natural fiber, embedded in plaster to provide tensile reinforcement and/or bonding. (also sometimes lath)*

**Moisture Barrier.** *A continuous barrier capable of stopping the passage of water.*

**Non-Loadbearing.** *(see non-structural)*

**Non-Structural.** *A strawbale wall or other element which supports only its own weight, and may resist out-of-plane lateral loads.*

**Pins.** *Metal rod, wood dowel, or bamboo, driven into, or secured on the surface of stacked bales for purposes of connection or stability.*

**Plaster.** *Gypsum, lime, lime-cement, or cement plasters, as defined by this code and Section L106 of this appendix, or clay plaster and earth-cement plaster as defined in Section L106.9 and L106.10.*

**Running Bond.** *The placement of straw bales such that the head joints in successive courses are offset at least one quarter the bale length.*

**Skin.** *The compilation of plaster and reinforcing, if any, on the surface of stacked bales.*

**Structural.** *A strawbale wall or other element which supports gravity loads (dead and live) and/or resists in-plane lateral loads.*

**Stack Bond.** *The placement of straw bales such that head joints in successive courses are vertically aligned.*

**Straw.** *The dry stems of cereal grains left after the seed heads have been substantially removed.*

**Straw Bale.** *A rectangular compressed block of straw, bound by polypropylene strings or baling wire.*

**Strawbale.** *The adjective form of straw bale.*

**Straw-clay.** *A mix of loose straw and clay binder.*

**Three-String Bale.** *A straw bale bound by three strings or wires. Typically with approximate dimensions of 15" x 23" x 42 to 48" long. (380mm x 584mm x 1066 to 1219mm)*

**Truth Window.** *An area of a strawbale wall left without its finish, to allow view of the straw otherwise concealed by its finish.*

**Two-String Bale.** *A straw bale bound by two strings or wires. Typically with approximate dimensions of 16" or 14" x 18" x 36 to 45" long (406mm or 356mm x 457mm x 914 to 1143mm)*

**Vapor-Permeable Membrane.** *A material or covering having a permeance rating of 5 perms or greater, when tested in accordance with the dessicant method using Procedure A of ASTM E 96. A vapor-permeable material permits the passage of moisture vapor. (This definition is shown for convenience and is identical to that shown in Chapter 2)*

**Vapor Retarder.** *A vapor-resistant material, membrane or covering such as foil, plastic sheeting or insulation facing having a permeance rating of 1 perm or less, when tested in accordance with the dessicant method using Procedure A of ASTM E 96. Vapor retarders limit the amount of moisture vapor that passes through a material or wall assembly. (This definition is shown for convenience and is identical to that shown in Chapter 2.)*

## **SECTION L103**

### **BALES**

**L103.1 Shape.** *Bales shall be rectangular in shape. However, the use of non-rectangular bales, such as circular bales, is not precluded.*

**L103.2 Size.** *Bales used within a continuous wall shall be of consistent height and width to ensure even distribution of loads within the wall system.*

**L103.3 Ties.** *Bales shall be bound with ties of polypropylene string or baling wire. Bales with broken or loose ties shall be firmly retied.*

**L103.4 Moisture content.** *The moisture content of bales, at the time of procurement, and at the time of application of the first coat of plaster or installation of another weather protective finish, shall not exceed 20 percent of the total weight of the bale. The moisture content of bales shall be determined by use of a moisture meter designed for use with baled straw or hay, equipped with a probe of sufficient length to reach the center of the bale, or by other acceptable means. At least ten bales, and not less than 5 percent, randomly selected from the bales to be used, may be tested to determine if all of the bales for the building are of acceptable moisture content.*

**L103.5 Density.** *Bales shall have a minimum dry density of 6.0 pounds per cubic foot (92 kg/cubic meter). The dry density shall be determined by reducing the actual bale weight by the weight of the moisture content in pounds (kg), and dividing by the volume of the bale in cubic feet (cubic meters). At least five bales, and not less than 2 percent, randomly selected from the bales to be used, may be tested to determine if all of the bales for the building are of acceptable density.*

**L103.6 Partial bales.** *Custom-made partial bales shall be firmly retied, and where possible use the same number of ties as the standard size bales.*

**L103.7 Types of straw.** *Bales of various types of straw, including wheat, rice, rye, barley, oat, and similar grain plants, shall be acceptable if they meet the minimum requirements of this Section for density, shape, moisture content, and ties. Bales of hay and other grasses containing seed shall not be used as a building material.*

**L103.8 Protection of bales prior to installation.** *Bales shall be stored in such a manner as to protect them from weather and other sources of moisture damage.*

**L103.9 Unacceptable bales.** *Bales which show signs of damage due to moisture, including but not limited to mold or fungus growth, or associated discoloration, even if they are of an acceptable moisture content and density, shall not be used.*

## **SECTION L104**

### **MOISTURE**

**L104.1 General.** *All weather-exposed bale walls, other weather-exposed bale elements, and bale walls enclosing showers or steam rooms, shall be protected from water damage.*

**L104.2 Moisture content of bales.** *(See L103.4)*

**L104.3 Moisture barriers and vapor retarders.** *Plastered bale walls may be constructed without any membrane barrier between straw and plaster, in order to facilitate transpiration of moisture from the bales, and to secure a structural bond between straw and plaster, except as allowed or required elsewhere in this appendix. No vapor retarder shall be used on bale walls, nor shall any other material be used which has a vapor permeance rating of less than 5 perms, except as permitted elsewhere in this appendix, or as demonstrated to be necessary by an architect or engineer.*

**L104.4 Horizontal surfaces.** *Bale walls and other bale elements shall have a moisture barrier at all horizontal surfaces exposed to the weather. This moisture barrier shall be of a material and installation that will prevent water from entering the wall system or other bale element. These horizontal surfaces include, but are not limited to, exterior window sills, sills at exterior niches, bale vaults and arches, tops of landscape walls, and weather-exposed benches. The finish material at all "horizontal" surfaces shall be sloped a minimum of 1"/ft.(8%) and shall drain away from all bale walls or elements. If the moisture barrier is below the finish material, it shall be sloped a minimum of 1"/ft.(8%) and shall drain beyond the outside vertical surface of the bale's vertical finish wherever practicable.*

**L104.5 Parapets – prohibited.** *Parapets made of straw bales are prohibited.*

**L104.6 Bale/Concrete separation.** *There shall be a moisture barrier and a capillary break between bales and supporting concrete. The moisture barrier may be any durable sheet or liquid applied membrane that is impervious to water. The capillary break may be gravel or other material that prevents the wicking of moisture across that material and into the bale. Where bales abut a concrete or masonry wall that retains earth, there shall be a moisture barrier between that wall and the bales.*

**L104.7 Separation of plaster and earth.** *Exterior plaster skins applied to straw bales shall be separated from the earth a minimum of 6" (152mm).*

**L104.8 Moisture barrier at plaster support.** *Where supported by the foundation at its bottom edge, there shall be a moisture barrier between the exterior plaster skin and the foundation.*

**L104.9 Shower walls, steam rooms.** *Bale walls enclosing showers, bathtub/shower combinations, or steam rooms shall be protected by a moisture barrier and may be protected by a vapor retarder.*

**L104.10 Paints and sealers.** *No paint, sealer, or other finish with a permeance of less than 5 perms shall be applied to plasters or other finish covering a bale wall or other bale element, unless demonstrated to be necessary by an architect or engineer.*

## **SECTION L105**

### **STRUCTURE**

**L105.1 Scope.** *Buildings constructed with straw bales shall comply with this Section, and with all other structural provisions of this code unless stated otherwise in this appendix.*

**L105.2 General.** *Strawbale buildings may use any type of structural system allowed by this code and this appendix.*

**L105.3 Foundations.** Foundations for strawbale walls and other straw bale elements may be of any foundation type permitted by this code. Such foundations shall comply with Chapter 18, and shall be designed to allow design loads from the skins, bales, and any structural framing at the base of the wall to pass into the ground.

**L105.4 Alternate foundations.** Alternate foundations and foundation systems may be used, if designed by an architect or engineer.

**L105.5 Wall height.** Structural and non-structural strawbale walls shall be limited by a 6:1 ratio of stacked bale height to bale width, unless otherwise shown by an architect or engineer to adequately resist buckling from gravity loads and out of plane seismic and wind loads. Walls may exceed this height limitation by having a structural element restraining the wall horizontally, at or below the height limitation, as designed by an architect or engineer.

**L105.6 Configuration of bales.** Bales may be laid flat or on-edge as limited in height by L105.5. Bales in walls with reinforced plasters may be in a running or stack bond. Bales in walls with unreinforced plaster shall be in a running bond only.

**L105.7 Pre-compression of strawbale walls.**

**L105.7.1 When not required:**

- a) For non-structural walls.
- b) For walls designed or allowed to resist lateral forces only.
- c) For walls bearing gravity roof loads, when the full dead load of the roof is imposed and remains on the wall for at least 28 days before plastering. No design snow load greater than 20 psf (80kg/sq.m) is allowed. No floor loads may be supported by walls which are not pre-compressed.

**L105.7.2 When required.** All walls bearing gravity loads, which are not described in L105.6.1, shall be pre-compressed to a force equal to or greater than the design loads on the wall.

**L105.8 Voids and stuffing.** Voids in the field of structural strawbale walls shall be limited to 6" (152mm) in width, and shall be firmly stuffed with flakes of straw or with straw-clay, before the application of plaster.

**L105.9 Plaster skins.**

**L105.9.1 General.** Plaster skins on structural walls may be of any type allowed by Section L106, except gypsum plaster, and shall also be limited by Table L105-A, and Table L105-B.

**L105.9.2 Straightness.** On structural walls, plaster skins shall be straight, as a function of the bale wall surface they are applied to, as follows:

- a) Across the face of a bale – Straw bulges shall not protrude more than 3/4" (19mm) across 2' (610mm) of its height or length.
- b) Across the face of a bale wall – Straw bulges shall not protrude from the vertical plane of a bale wall more than 2 1/2" (64mm) over 8' (2438mm).
- c) Offset of bales – The vertical face of adjacent bales may not be offset more than 3/4" (19mm)

**L105.9.3 Plaster and membranes.** Structural bale walls shall have no membrane between straw and plaster, or shall have sufficient attachment through the bale wall from one plaster skin to the other, as designed by an architect or engineer. See also L106.5 and L106.6.

**L105.10 Transfer of loads into plaster skins.** When plastered strawbale walls are used to bear gravity and/or lateral loads, such loads shall be transferred into the plaster skins by direct bearing or by other adequate transfer mechanism.

**L105.11 Support of plaster skins.**

**L105.11.1 For structural walls.** Plaster skins for structural strawbale walls shall be continuously supported along their bottom edge to allow a load path into the foundation system. Acceptable supports include, but are not limited to: concrete or masonry footing, concrete slab, wood-framed floor adequately blocked, wood beam, or steel angle adequately anchored. A conventional metal or plastic weep screed is not an acceptable support.

**L105.11.2 For non-structural walls.** *Plaster skins for non-structural walls need not be supported along their bottom edge.*

**L105.12 Allowable gravity loads on strawbale walls.** *As allowed by Table L105-A, or as shown by rational analysis by an architect or engineer.*

**L105.13 Allowable shear value for plastered strawbale walls.** *As allowed by Table L105-B, or as shown by rational analysis by an architect or engineer.*

**L105.14 Resistance to out-of-plane lateral loads.** *Plastered strawbale walls are capable of withstanding out-of-plane design loads prescribed in this code with the following limitations:*

1. *Walls with reinforced plasters shall be limited by a 6:1 ratio of stacked bale height to bale width per L105.5.*
2. *Walls with unreinforced plasters shall be limited by a 4:1 ratio of stacked bale height to bale width.*
3. *Walls with unreinforced plasters or no plaster, and with internal or external pins, shall be limited by a 6:1 ratio of stacked bale height to bale width. Pins may be 1/2" (13mm) diameter steel, wood or bamboo. Internal pins shall be installed vertically at a maximum 2' (61mm) spacing into the bales from top course to bottom course, with the bottom course being connected to its support similarly with pins or other approved means. Pins may be continuous or may overlap through one bale course. External pins shall have full lateral bearing on the sill plate and the roof or floor bearing member, and shall be tightly tied through the wall to an opposing pin with polypropylene string at 30" maximum spacing.*

**L105.15 Prescriptive design using structural strawbale walls.**

**L105.15.1 General.** *Plastered strawbale walls may be used structurally, without design by an architect or engineer, as described in this subsection. Such walls shall also comply with L105.5 through L105.11, and 105.14 of this Section and shall comply with other Sections of this appendix as applicable.*

**L105.15.2 Load and other limitations.** *As described in 2308.2 - 3 through 7, and 2308.2.2.*

**L105.15.3 Gravity load bearing walls.** *Limited to wall types B, C, D, and E in Table L105-A. Type A walls may be used if they are demonstrated to support design loads no greater than the allowable load.*

**L105.15.4 Braced panels.** *Strawbale shear walls may be used as braced panels per the requirements and limitations in 2308.9.3 Bracing, and per 2308.12 Additional requirements for conventional construction in Seismic Design Category D or E. Strawbale shear wall types B, C, D, and E, shown in Table L105-B, may be used in situations where braced wall panel types 2., 3., 4., 6., and 7. are allowed. Strawbale shear wall type A may be used in situations where braced wall panel types 1. and 5. are allowed.*

**L105.16 Connection of framed walls to strawbale walls.** *Framed walls perpendicular to, or at an angle to a straw bale wall assembly, need only be fastened to the bottom and top wood members of the strawbale wall per framing connections permissible in this code. Where such connection is not possible, the abutting stud shall be connected to alternating straw bale courses with a 1/2" (1.25cm) diameter steel, wood, or bamboo dowel with minimum 8" (20cm) penetration.*

**L105.17 Alternate Performance Design Criteria.** *When plastered strawbale walls or other elements are engineered, they may use the model of restrained, thin shell, reinforced concrete, as in the American Concrete Institute's ACI-318 Manual. This model may be used for all reinforced plasters, including those without cement. Such design and analysis shall be made in accordance with the following:*

- a) *General. Strawbale structural systems and elements shall be designed using engineering principles, fundamental engineering behavior, and principles of mechanics.*
- b) *Rationality. Strawbale structural elements shall be designed based on a rational analysis in accordance with established principles of mechanics. These elements shall provide a complete load path capable of transferring all loads and forces from their point of origin to the load-resisting elements based on a rational connection of components.*
- c) *System Characteristics. Strength, stiffness and toughness (ductility) characteristics, of the bales and their skins, shall be considered in the design of the system.*

## **SECTION L106**

### **FINISHES**

**L106.1 General.** *Finishes applied to strawbale walls may be of any type permitted by this code, and shall comply with this Section and the provisions of Chapter 14 and Chapter 25 unless stated otherwise in this Section.*

**L106.2 Purpose, and where required.** *Strawbale walls and other strawbale elements shall be finished so as to provide mechanical and fire protection of the bales, restrict the passage of air through the bales, and to protect them from weather.*

**Exception:** *Truth windows are allowed, but shall be protected from weather.*

**L106.3 Vapor retarders.** *No vapor retarder may be used on a bale wall, nor shall any other material be used which has a vapor permeance rating of less than 5 US perms, except as permitted elsewhere in this appendix, or as demonstrated to be necessary by an architect or engineer.*

**L106.4 Plaster.** *Plaster applied to bales may be of any type described in this section.*

**L106.5 Plaster and membranes.** *Plaster may be applied directly to strawbale walls and other strawbale elements, in order to facilitate transpiration of moisture from the bales, and to secure a mechanical bond between the skin and the bales, except where a membrane is allowed or required elsewhere in this appendix. Structural bale walls shall have no membrane between straw and plaster, or shall have sufficient attachment through the bale wall from one plaster skin to the other, as designed by an architect or engineer.*

**L106.6 Lath and mesh for plaster.** *In strawbale construction the surface of the straw bales functions as lath, and no other lath or mesh is necessary, except as required for tensile strength of the plaster and/or wall assembly in particular structural applications (see Section L105). Straw bales laid flat or on-edge provide a sufficient mechanical bonding surface between plaster and straw.*

**L106.7 Plaster on non-structural walls.** *Plaster on walls that do not carry gravity loads, and are not designed to resist in-plane lateral forces, may be any plaster as described in this Section.*

**L106.8 Plaster on structural walls.** *Plaster on structural walls shall comply with L105.9 through L105.11. Plaster on walls that carry gravity loads shall comply with Table L105-A. Plaster on walls designed to resist in-plane lateral forces, shall comply with Table L105-B.*

**L106.9 Clay plaster. (Also known commonly as earth or earthen plaster)**

**L106.9.1 General.** *Clay plaster is any plaster whose binder is comprised primarily of clay. Clay plasters may also contain sand or other inert granular material, and may contain reinforcing fibers. Acceptable reinforcing fibers include, but are not limited to, chopped straw, hemp fiber, nylon fiber, and animal hair.*

**L106.9.2 Mesh.** *Clay plaster may have no mesh, or may use a natural fiber mesh, corrosion-resistant metal mesh, or high-density polypropylene mesh.*

**L106.9.3 Thickness.** *Clay plaster shall be a minimum 1" (25mm) thick, unless required to be thicker for structure or fire-resistance, as described elsewhere in this appendix.*

**L106.9.4 Rain-exposed.** *Clay plaster, where exposed to rain, shall be finished with lime plaster, or other erosion resistant finish.*

**L106.9.5 Prohibited finish coat.** *Cement plaster and cement-lime plaster are prohibited as a finish coat over clay plasters*

**L106.9.6 Additives.** *Additives may be used to increase the plaster's workability, durability, strength, or water resistance.*

**L106.9.7 Separation of wood and clay plaster.** *No separation or moisture barrier is required between untreated wood and clay plaster.*

**L106.10 Earth-cement plaster.** (Also known commonly as soil-cement, stabilized earth, or pise')

**L106.10.1 General.** Earth-cement plaster is comprised of earth (free of organic matter) and Portland cement, and may include sand or other inert granular material, and may contain reinforcing fibers.

**L106.10.2 Mesh.** Earth-cement plaster shall use any corrosion-resistant metal mesh permitted by this code, and as described in Section L105 if used on a structural wall.

**L106.10.3 Thickness.** Earth-cement plaster shall be a minimum of 1 1/2" (38mm) thick.

**L106.11 Gypsum plaster.**

**L106.11.1 General.** Gypsum plaster shall comply with Section 2511 of this code.

**L106.11.2 Restriction of use.** Gypsum plaster is limited to use on interior surfaces, and on non-structural walls, except as a finish coat over an allowed structural plaster.

**L106.12 Lime plaster.**

**L106.12.1 General.** Lime plaster is any plaster whose binder is comprised primarily of calcium hydroxide (CaOH). This includes Type N or Type S hydrated lime, natural hydraulic lime, or quicklime. Lime plasters shall comply with ASTM Standards C5 and C206. The plaster may be applied in 2 coats, provided that the combined thickness is at least 7/8" (22mm), and each coat is no greater than 5/8" (16mm).

**L106.13 Cement-lime plaster.**

**L106.13.1 General.** Cement-lime plaster shall comply with Section 2508 of the 1997 UBC, except that the plaster may be applied in 2 coats, provided that the combined thickness is at least 7/8" (22mm), and each coat is no greater than 5/8" (16mm).

**L106.14 Portland cement plaster.**

**L106.14.1 General.** Portland cement plaster shall comply with Section 2512 of this code, except that the amount of lime in all plaster coats shall be a minimum of 1 part lime per 6 parts cement so as to allow a minimum acceptable vapor permeability. The plaster may be applied in 2 coats, provided that the combined thickness is at least 7/8" (22mm), and each coat is no greater than 5/8" (16mm). The combined thickness of all plaster coats shall be no more than 1 1/2" (38mm).

**L106.15 Alternate plasters.** Plasters, or variations, which do not fit in any other category described in this Section, may be allowed if such plasters are demonstrated to be appropriate for the particular application.

**L106.16 Finishes over plaster.** Other finishes, as permitted elsewhere in this code, may be applied over the plaster, except as prohibited in L106.17.

**L106.17 Prohibited plasters and finishes.** Any plaster or finish with a cumulative perm rating of <5 perms is prohibited on straw bale walls or other bale elements, unless demonstrated to be necessary by an architect or engineer.

**L106.18 Separation of wood and plaster.** Where wood framing or wood sheathing occur in strawbale walls, such wood surfaces shall be separated from any plaster finish with No. 15 asphalt felt, grade 'D' paper, or other approved material per Section 1404.2 of this code, unless the wood is preservative-treated or naturally durable.

**Exception:** Clay plasters. See L106.9.7.



## **SECTION L107**

### **FIRE-RESISTANCE**

#### **L107.1 Fire-resistance rating.**

**L107.2.1 Rating with plaster finish.** *Plastered strawbale walls have a 1-hour fire-resistance rating, provided the components of the wall fit within the following parameters:*

- a) *Bales may be laid flat or on-edge.*
- b) *The bale wall must have a minimum unplastered thickness of 12" (304mm).*
- c) *Bales may be installed in a running bond or stack bond, but vertical joints in a stack bond, and continuous vertical gaps at any posts within both types of wall, must be fire-stopped with straw-clay, or equivalent.*
- d) *The wall must be finished on both sides and exposed ends with a plaster of any type allowed by this appendix, and clay plasters must be a minimum 1 1/2" (38mm) thick, and a minimum of 2 layers.*

**L107.2.2 Rating with other finishes.** *Strawbale walls covered with finish materials other than, or in addition to plaster, shall be deemed to have the equivalent fire resistive rating as wood-frame construction covered with the same finish materials.*

**L107.3 Permitted in types of construction.** *Strawbale walls with a 1-hour fire-resistance rating per Section L107.2 are permitted wherever combustible 1-hour walls are allowed by Chapter 6. Such walls and unrated strawbale walls with any finish allowed by this code are permitted wherever combustible no-hour walls are allowed by Chapter 6.*

**L107.4 Openings in rated walls.** *Openings and penetrations in any straw bale wall rated for, and required to have a particular fire-resistance rating, for a particular application, shall satisfy the same requirements for openings and penetrations as stated elsewhere in this code.*

**L107.5 Clearance to fireplaces and chimneys.** *Strawbale surfaces adjacent to fireplaces or chimneys shall have a minimum 1/4" (6mm) thick plaster coat of any type permitted by this appendix, and shall maintain the specified clearances to the plaster finish as required to combustibles in Sections 2111, 2112, and 2113, or as required by manufacturers of prefabricated fireplaces and chimneys, or as required to combustibles elsewhere in this code.*

## **SECTION L108**

### **ELECTRICAL**

**L108.1 Scope.** *Wiring and other elements of the electrical system, within or on bale walls, shall comply with all Sections of this code which govern electrical systems and with the California Electrical Code, unless otherwise stated in this Section.*

**L108.2 Wiring.** *Type NM or UF cable may be used, or wiring may be run in metallic or non-metallic conduit. Wiring which is unprotected by conduit shall be installed a minimum of 2" (50mm) from the face of the bale, except as necessary to enter or exit a junction box. The wiring shall be pushed into joints between bales, or into the bale itself, or the bales may be channeled to receive the wire.*

**L108.3 Wiring attachment.** *Where not held securely between bales or within a bale, and not attached via staples to a wood member, wiring on straw bale walls shall be attached with minimum 17 ga. wire in a 'U' configuration, with minimum 8" (203mm) long legs, as needed to comply with minimum attachment requirements specified elsewhere in this code and in the California Electrical Code.*

**L108.4 Attachment of electrical boxes.** *Electrical boxes on bale walls shall be securely fastened to non-bale structural elements, or to wooden stakes driven a minimum of 12" (304mm) into the bales, or shall be secured by the combination of wire mesh and plaster, or by an acceptable equivalent method.*

**L108.5 Attachment of service and subpanels.** *Electrical service and subpanels on bale walls shall be securely fastened to wood structural members, or to other wood members which have been adequately fastened to the straw bales.*

TABLE L105-A

WALL	PLASTER <sup>1</sup>	SILL PLATES <sup>23</sup>	ANCHOR <sup>c</sup> BOLTS (or other sill fastening)	MESH <sup>4</sup>	STAPLES <sup>567</sup>	ALLOWABLE BEARING CAPACITY <sup>8</sup>
A	clay <sup>9</sup>	c	c	none required <sup>10</sup>	none required <sup>j</sup>	300
B	earth-cement <sup>11</sup>	c	c	d	e,f,g	800
C	lime	c	c	d	e,f,g	450
D	cement-lime	c	c	d	e,f,g	800
E	portland cement <sup>12</sup>	c	c	d	e,f,g	800

**ALLOWABLE GRAVITY LOADS (POUNDS PER FOOT) FOR PLASTERED STRAWBALE WALLS**

For SI: 1 inch=25.4mm, 1 pound per foot = 14.5939 N/m.

<sup>1</sup> Plasters shall conform with L106.9 through L106.14 for makeup and thickness, with L105.9.2 for straightness, and with L105.11 for support of plaster skins.

<sup>2</sup> Sill plates shall support and be flush with each face of the bale wall.

<sup>3</sup> For walls supporting gravity loads only (or for non-structural walls), use sill plates and fastening as required for framed walls in 2308.2 and 2308.3. See Table L105-B for requirements for shear walls and braced panel walls.

<sup>4</sup> May be any metal mesh allowed by this code, and must be installed throughout the plaster with minimum 4" laps. Fasten with staples per footnote e.

<sup>5</sup> Staples shall be at maximum spacing of 2" o.c., to roof or floor bearing assembly, or as shown necessary to transfer loads into the plaster skins per L105.10, and at a maximum spacing of 4" o.c. to sill plates.

<sup>6</sup> Staples shall be gun staples (stainless steel or electro-galvanized, 16 gauge with 1 1/4" legs, 7/16" crown) or manually driven staples (galvanized 15 gauge with 7/8" legs, 3/16" inner spread and rounded shoulder). Other staples may be used as designed by an architect or engineer.

<sup>7</sup> Staples shall be firmly driven, diagonally across mesh intersections at spacing indicated.

<sup>8</sup> For walls with a different plaster on each side, use the lower value.

<sup>9</sup> Minimum 1 1/2" thickness. Building official may require a compression test to demonstrate a minimum 100 psi compressive strength.

<sup>10</sup> Except as necessary to transfer roof or floor loads into the plaster skins per L105.10.

<sup>11</sup> Minimum 1 1/2" thickness. Building official may require a compression test to demonstrate a minimum 1000 psi compressive strength.

<sup>12</sup> Containing lime as described in L106.14.

TABLE L105-B

WALL	PLASTER <sup>13</sup> (both sides)	SILL PLATES <sup>14</sup>	ANCHOR <sup>15</sup> BOLTS (on center)	MESH <sup>16</sup>	STAPLES <sup>17/18</sup> <sup>19</sup> (on center)	ALLOWABLE SHEAR <sup>20,21</sup>
A1	clay <sup>22</sup>	2x4	2'-8"	none	none	100
A2	clay <sup>l</sup>	2x4	2'-8"	3"x3" knotted hemp	3"	120
A3	clay <sup>l</sup>	4x4	2'-0"	2"x2" high-density polypropylene	2"	140
A4	clay <sup>l</sup>	4x4	2'-0"	2"x2"x14ga <sup>23</sup>	2"	180
B	earth-cement <sup>24</sup>	4x4	2'-0"	2"x2"x14ga <sup>k</sup>	2"	400
C1	lime	2x4	2'-8"	17ga. woven wire	4"	200
C2	lime	4x4	2'-0"	2"x2"x14ga. <sup>k</sup>	2"	250
D1	cement-lime	4x4	2'-8"	17ga. woven wire	2"	400
D2	cement-lime	4x4	2'-0"	2"x2"x14ga. <sup>k</sup>	2"	450
E1	portland cement <sup>25</sup>	4x4	2'-8"	17ga. woven wire	2"	500
E2	portland cement <sup>m</sup>	4x4	2'-0"	2"x2"x14ga. <sup>k</sup>	2"	600

**ALLOWABLE SHEAR (POUNDS PER FOOT) FOR PLASTERED STRAWBALE WALLS**

<sup>13</sup> Plasters shall conform with L106.9 through L106.14 for makeup and thickness, with L105.9.2 for straightness, and with L105.11 for support of plaster skins.

<sup>14</sup> Sill plates shall be Douglas fir-larch or southern pine and shall be preservative-treated if in contact with concrete or masonry slabs or foundation walls. Multiply allowable shear value by .82 for other species with specific gravity of .42 or greater, or by .65 for all other species.

<sup>15</sup> Anchor bolts shall be 5/8" diameter with 2"x2"x3/16" washers, with minimum 7" embedment in concrete foundation. Anchor bolts or other fasteners into framed floors shall be designed by an architect or engineer.

<sup>16</sup> Mesh shall run continuous vertically from sill plate to top plate, roof or floor beam, or roof or floor bearing assembly, or shall lap a minimum 12". Horizontal laps shall be minimum 4". Steel mesh shall be galvanized.

<sup>17</sup> Staples shall be gun staples (stainless steel or electro-galvanized, 16 gauge with 1 1/4" legs, 7/16" crown) or manually driven staples (galvanized 15 gauge with 7/8" legs, 3/16" inner spread and rounded shoulder). Other staples may be used as designed by an architect or engineer.

<sup>18</sup> Staples at spacing indicated to boundary conditions including sill plate, and top plate, roof or floor beam, or roof or floor bearing assembly, and any vertical boundary framing.

<sup>19</sup> Staples shall be firmly driven, diagonally across mesh intersections at spacing indicated.

<sup>20</sup> Values shown are for aspect ratios of 1:1 or smaller. Reduce values shown to 50% for the limit of a 2:1 aspect ratio. Linear interpolation is allowed for ratios between 1:1 and 2:1. The full value shown may be used for aspect ratios greater than 1:1, if an additional band of mesh is installed at the base of the wall to a height where the remainder of the wall has an aspect ratio of 1:1 or less, and the second mesh is fastened to the sill plate with the required stapling, and the sill bolt spacing is decreased with linear interpolation between 1:1 and 2:1.

<sup>21</sup> For walls with a plaster type A on one side and any other plaster type on the other side, the architect or engineer must show transfer of the design lateral load into the stiffer type B, C, D, or E plaster only, and 50% of the allowable shear value shown for that wall type shall be used.

<sup>22</sup> Minimum 1 1/2" thickness. Building official may require a compression test to demonstrate a minimum 100 psi compressive strength.

<sup>23</sup> 16 gauge mesh may be used with a reduction to .85 of the allowable shear values shown.

<sup>24</sup> Minimum 1 1/2" thickness. Building official may require a compression test to demonstrate a minimum 1000psi compressive strength.

<sup>25</sup> Containing lime as described in L106.14.

For SI: 1 inch=25.4mm, 1 pound per foot = 14.5939 N/m

**NOTE:**

Authority: Health and Safety Code Sections 17040, 17921, 17922, 18300, 18865 and 19990; and Government Code Sections 12955.1 and 12955.1.1.

Reference: Health and Safety Code Sections 17000 through 17060, 17910 through 17990, 18620, 18630, 18640, 18670, 18690, 18691, 18873 through 18873.5 and 19960 through 19997; and Government Code Sections 12955.1 and 12955.1.1.